CLAIMS:

1. An apparatus for selectively engaging one of a plurality of gears in a transmission, comprising:

at least a first shift rail and a second shift rail, each being arranged and constructed such that movement of the respective shift rails in a first axial direction or second axial direction controls engagement of one of a pairs of gear,

a rotatable drive shaft having a rotational axis,

a first shift finger mounted on the drive shaft so as to be rotatable therewith about the rotational axis, and to be pivotable with respect to the drive shaft in a plane parallel to the rotational axis of the drive shaft,

a second shift finger mounted on the drive shaft so as to be selectively rotatable therewith, wherein the second shift finger forms a first limb of a first bell crank lever, which first limb permanently engages the second shift rail, and the first bell crank lever also comprises a second limb, and wherein the first shift finger is pivotable in a first position so as selectively engage the first shift rail and the first shift finger is pivotable in a second position so as to selectively engage the second limb of the first bell crank lever, and

means for pivoting the first shift finger.

2. An apparatus according to claim 1, wherein the rotational axis of the drive shaft is substantially perpendicular to the direction of the axial movement of the respective shift rails and the first and second shift fingers are rotatable in planes that are substantially parallel to direction of axial movement of the respective shift rails.

3. An apparatus according to claim 2, further comprising:

at least a third shift rail, and

at least a second bell crank lever mounted on and selectively rotatable with the drive shaft, wherein a first limb of the second bell crank lever is permanently engaged with the third shift rail and a second limb of the second bell crank lever is spaced angularly of the second limb of the first bell crank lever when the shift rails are disposed in a neutral position,

the first shift finger being selectively engageable with the second limb of the second bell crank lever in a third position.

4. An apparatus according to claim 3, wherein slots are defined in each of the respective second limbs of the first and second bell crank levers, the slots being arranged and constructed to be engageable by the first shift finger when pivoted to its engaged position from its disengaged position, and wherein the slots extend axially of the drive shaft so that, when engaged by the first shift finger, rotation of the first shift finger causes rotation of the respective bell crank lever.

5. An apparatus according to claim 4, further comprising a guide plate disposed in a fixed axial and rotational position between the engaged and disengaged positions of the first shift finger, the guide plate having apertures shaped to permit the first shift finger to move between the disengaged and engaged positions only when the first shift finger is accurately aligned with a notch in the first shift rail or with one slot of one of the bell crank levers.

6. An apparatus according to claim 5, further comprising:

a hub fixedly defined on the drive shaft, the hub having an axially-extending diametrical slot, the first shift finger being mounted in the diametrical slot for pivotal movement about a pivot pin, the axis of the pivot pin being transverse to the rotational axis of the drive shaft, the drive shaft passing through an elongated aperture defined in the first shift finger, and

wherein the means for moving the first shift finger between the engaged and disengaged positions comprises:

a push rod coupled to the first shift finger so as to cause movement of the first shift finger between the engaged and disengaged positions, and

means for moving the push rod.

7. An apparatus according to claim 6, wherein the push rod moving means comprises a solenoid actuator arranged and constructed to move the first shift finger between the disengaged and engaged positions.

8. An apparatus according to claim 7, wherein the solenoid actuator is mounted coaxially with the drive shaft.

9. An apparatus according to claim 8, wherein the push rod is slidably disposed within an axial bore defined in the drive shaft, an inner end of the push rod is pivotally connected to the first shift finger via a pivot pin, and the pivot pin extends transversely to the rotational axis of the drive shaft through an axially-extending diametrical slot.

10. An apparatus according to claim 9, wherein the first shift finger is normally biased towards the disengaged position.

11. An apparatus according to claim 10, further comprising an electric motor arranged and constructed to rotationally drive the drive shaft, the electric motor being coupled to the drive shaft via a gear train.

12. An apparatus according to claim 11, further comprising a reduction gearbox coupling the electric motor to the drive shaft.

13. An apparatus according to claim 10, further comprising a brake mechanism arranged and constructed to act upon the drive shaft so as to prevent rotation of the drive shaft when no torque is applied to the drive shaft.

14. An apparatus according to claim 13, wherein the brake mechanism comprises:

a rotor having a plurality of projections, the projections being spaced angularly of one another and each including a resilient, radially-extending portion and an axially-extending portion spaced radially of a rotational axis of the rotor,

a mass coupled to each axially-extending portion, and

a stator having an annular plug disposed coaxially of the rotor, wherein the stator, rotor and masses are arranged and constructed such that an external surface of the plug is frictionally engaged by the masses when the rotor is stationary, and such that when the rotational speed of the rotor exceeds a threshold value, frictional engagement between the stator and rotor reduces at least to substantially zero due to centrifugal loading of the masses.

15. An apparatus according to claim 1, further comprising:

a hub fixedly defined on the drive shaft, the hub having an axially-extending diametrical slot, the first shift finger being mounted in the diametrical slot for pivotal movement about a pivot pin, the axis of the pivot pin being transverse to the rotational axis of the drive shaft, and the drive shaft passing through an elongated aperture defined in the first shift finger, and

wherein the means for moving the first shift finger between the engaged and disengaged positions comprises:

a push rod coupled to the first shift finger so as to cause movement of the first shift finger between the engaged and disengaged positions, and

means for moving the push rod.

16. An apparatus according to claim 15, wherein the push rod moving means comprises a solenoid actuator arranged and constructed to move the first shift finger between the disengaged and engaged positions, the solenoid actuator is mounted coaxially with the drive shaft, the push rod is slidably disposed within an axial bore defined in the drive shaft, an inner end of the push rod is pivotally coupled to the first shift finger via a pivot pin, the pivot pin extends transversely to the rotational axis of the drive shaft through an axially-extending diametrical slot and the first shift finger is normally biased towards its disengaged position.

17. An apparatus according to claim 1, further comprising an electric motor arranged and constructed to rotatably drive the drive shaft.

18. An apparatus according to claim 17, wherein the electric motor is coupled to the drive shaft via a gear train.

19. An apparatus according to claim 18, further comprising a reduction gearbox coupling the electric motor to the drive shaft.

20. An apparatus according to claim 1, further comprising a brake mechanism arranged and constructed to act upon the drive shaft so as to prevent rotation of the drive shaft when no torque is being applied to the drive shaft.

21. An apparatus according to claim 20, wherein the brake mechanism comprises:

a rotor having a plurality of projections, the projections being spaced angularly of one another and each including a resilient, radially-extending portion and an axially-extending portion spaced radially of the rotational axis of the rotor,

a mass coupled to each axially-extending portion, and

a stator having an annular plug disposed coaxially of the rotor, wherein the stator, rotor and masses are arranged and constructed such that an external surface of the plug is frictionally engaged by the masses when the rotor is stationary, and such that when the rotational speed of the rotor exceeds a threshold value, frictional engagement between the stator and rotor reduces at least to substantially zero due to centrifugal loading of the masses.

22. An apparatus according to claim 21, wherein the axially-extending portions of the projections are U-shaped, apertures are defined in the inner and outer limbs of the U-shaped portions, the masses are steel balls and the apertures are arranged and constructed to securely locate the steel balls.

23. An apparatus according to claim 22, wherein the steel balls protrude through the apertures in the inner limbs of U-shaped portions, a shallow arcuate circumferential groove is defined in the stator, and the groove is arranged and constructed to be frictionally engaged by the steel balls when the rotor is stationary.

24. A brake mechanism for a rotary drive comprising:

a rotor having a plurality of projections, wherein the projections are spaced angularly of one another and each projection includes a resilient, radially-extending portion and an axially-extending portion spaced radially of the rotational axis of the rotor,

a mass coupled to each axially-extending portion, and

a stator having an annular plug disposed coaxially of the rotor, wherein the stator, rotor and masses are arranged and constructed such that an external surface of the plug is frictionally engaged by the masses when the rotor is stationary, and such that when the rotational speed of the rotor exceeds a threshold value, frictional engagement between the stator and rotor reduces at least to substantially zero due to centrifugal loading of the masses.

25. A brake mechanism according to claim 24, wherein the axially-extending portions of the projections are U-shaped, apertures are defined in the inner and outer limbs of the U-shaped portions, the masses are steel balls and the apertures are arranged and constructed to securely engage and locate the steel balls.

26. A brake mechanism according to claim 25, wherein the steel balls protrude through the apertures in the inner limbs of U-shaped portions, a shallow arcuate circumferential groove is defined in the stator, and the groove is arranged and constructed to be frictionally engaged by the steel balls when the rotor is stationary.